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<p>(21) International Application Number: PCT/US95/13816 (22) International Filing Date: 26 October 1995 (26.10.95) (30) Priority Data: 9423181.8 17 November 1994 (17.11.94) GB (71) Applicant (for all designated States except US): THE PROCTER &amp; GAMBLE COMPANY [US/US]; One Procter &amp; Gamble Plaza, Cincinnati, OH 45202 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): BRIGGS, Gillian, Scott [GB/GB]; 73 Clarence Street, Egham, Surrey TW20 9QY (GB). FISH, Karen [GB/FR]; 52, rue M.-Michelis, F-92200 Neuilly-sur-Seine (FR). JENKINS, Delyth, Myfanwy [GB/GB]; 10 Irvine Place, Virginia Water, Surrey GU25 4DQ (GB). MALTON, Peter, James [GB/GB]; 12 Lammas Court, Moor Lane, Staines, Middlesex TW19 6EA (GB). (74) Agents: REED, T., David et al.; The Procter &amp; Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217 (US).</p>		<p>(81) Designated States: CA, CN, JP, MX, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published With international search report.</p>
<p>(54) Title: COSMETIC COMPOSITIONS IN STICK FORM</p> <div style="text-align: center; margin: 20px 0;"> <math display="block">  \begin{array}{ccccccc}  &amp; \text{CH}_3 &amp; &amp; \text{CH}_3 &amp; &amp; \text{CH}_3 &amp; &amp; \text{CH}_3 \\  &amp;   &amp; &amp;   &amp; &amp;   &amp; &amp;   \\  \text{CH}_3 - &amp; \text{Si} &amp; - \text{O} &amp; - \text{Si} &amp; - \text{O} &amp; - \text{Si} &amp; - \text{O} &amp; - \text{Si} - \text{CH}_3 \\  &amp;   &amp; &amp;   &amp; &amp;   &amp; &amp;   \\  &amp; \text{CH}_3 &amp; &amp; \text{CH}_2\text{CH}_2\text{R} &amp; &amp; \text{CH}_3 &amp; &amp; \text{CH}_3  \end{array}  \quad \text{(I)}  </math> <div style="display: flex; justify-content: center; gap: 100px; margin-top: -10px;"> <span style="border-left: 1px solid black; height: 100px; width: 10px;"></span> <span style="border-left: 1px solid black; height: 100px; width: 10px;"></span> <span style="border-left: 1px solid black; height: 100px; width: 10px;"></span> </div> <div style="display: flex; justify-content: center; gap: 100px; margin-top: 10px;"> <span>x</span> <span>y</span> </div> </div> <p>(57) Abstract</p> <p>Cosmetic composition in the form of a non-oily solid stick comprising wax, branched chain aliphatic hydrocarbon having a weight average molecular weight of from about 100 to about 15,000 and silicone or mixture of silicones, the silicone or silicone mixture comprising an alkylmethylsiloxane polymer having formula (I) wherein x has a value of from about 1 to about 1000, y has a value of from about 0 to 1000 and R is selected from C<sub>4</sub>-C<sub>30</sub> alkyl. The composition provides good application characteristics and/or anti-acne activity.</p>		

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## Cosmetic Compositions in Stick Form

### Technical Field of the Invention

The present invention relates to cosmetic compositions in stick form. In particular the present invention relates to cosmetic compositions in stick form which provide good application characteristics and/or anti-acne efficacy.

### Background of the Invention

Cosmetic compositions in the form of sticks such as concealers and lipsticks are well known in the cosmetic art. However many of these products have not always been successful from the viewpoint of skin feel, spreadability and application.

It would also be desirable to provide a cosmetic stick composition having prolonged topical anti-acne and/or anti-bacterial activity. There are many compounds which are known to exhibit anti-acne and/or anti-bacterial properties when applied topically to the skin. A commonly used keratolytic agent having anti-acne activity is salicylic acid. Zinc oxide is also known for use in cosmetic compositions.

Castor oil is a major ingredient of many lipstick and concealer formulations. It can generally comprise up to 40% of lipsticks. The high percentage of castor oil is primarily due to its unique properties as a wetting agent for pigments. Monodispersions of pigments are commonly made in slurries comprising from about 30% to about 40% pigments and from about 60% to about 70% castor oil. However the presence of castor oil in such compositions can lead to "sweating". In addition, compositions which are greasy can often aggravate the skin and lead to blocked pores and spots. Therefore it would be desirable to provide a cosmetic stick composition which does not contain castor oil or other animal or vegetable oil components which are liquid under ambient conditions (25°C), the effect of which is to cause the composition to be greasy.

It is accordingly a primary object of this invention to provide a cosmetic composition in the form of a stick having improved anti-acne activity.

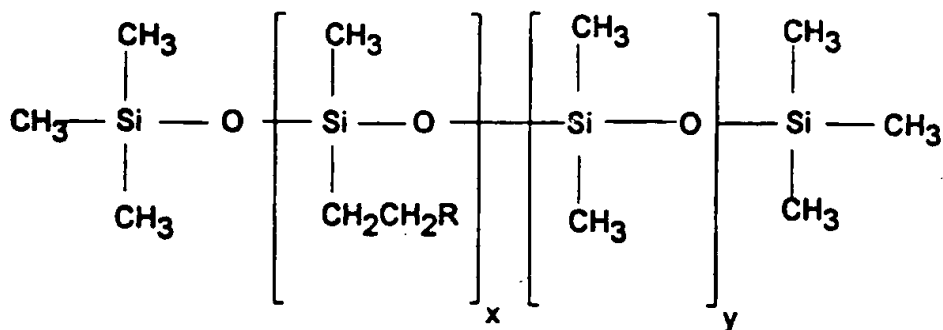
It is also an object of this invention to provide a cosmetic composition in the form of a stick having improved spreadability, skin feel and application characteristics.

It is a further object of this invention to provide a cosmetic composition in the form of a stick which is non-greasy.

### Summary of the Invention

In accordance with one aspect of the present invention there is provided a cosmetic composition in the form of a non-oily solid stick comprising:

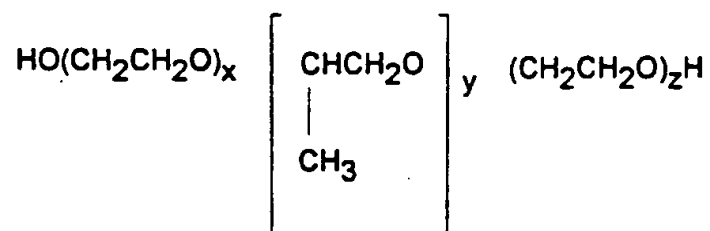
- (a) from about 5 % to about 70 % by weight of wax;
- (b) from about 1 % to about 40 % by weight of branched chain aliphatic hydrocarbon having a weight average molecular weight of from about 100 to about 15,000; and
- (c) from about 0.01 % to about 10 % by weight of silicone or mixture of silicones, the silicone or silicone mixture comprising an alkylmethylsiloxane polymer having the formula:



wherein x has a value of from about 1 to about 1000, y has a value of from about 0 to 1000 and R is selected from C<sub>4</sub>-C<sub>50</sub> alkyl.

In accordance with another aspect of the present invention there is provided a cosmetic composition in the form of a non-oily solid stick comprising:

- (a) from about 5% to about 70% by weight of wax;
- (b) from about 1% to about 20% by weight of a polyoxyethylene-polyoxypropylene block copolymer having the formula:



wherein x has an average value of from about 1 to about 130, y has an average value of from about 10 to about 75 and z has an average value of from about 1 to about 130; and

- (c) from about 0.1% to about 10% by weight of acidic anti-acne active;

and wherein the anti-acne active is pre-solubilised in the polyoxyethylene-polyoxypropylene block copolymer.

In accordance with a further aspect of the invention there is provided a cosmetic composition in the form of a non-oily solid stick comprising:

- (a) from about 5% to about 70% by weight of wax;
- (b) from about 3% to about 20% by weight of zinc oxide.
- (c) from about 0.01% to about 10% by weight of anti-acne active.

The compositions of the present invention provide improved anti-acne activity, skin feel, spreadability and application characteristics.

All levels and ratios are by weight of total composition unless otherwise indicated. Chain length and degrees of alkoxylation are also specified on a weight average basis.

### Detailed Description of the Invention

The cosmetic composition according to one aspect of the present invention comprises wax, branched chain hydrocarbon and silicone or mixture of silicones. The cosmetic composition is formulated as a stick and is preferably oil-free, ie. contains less than about 5%, more preferably less than about 1% of non-hydrocarbon oils which are liquid under ambient conditions (25°C), especially oils of animal or vegetable origin such as castor oil.

A first essential component of the compositions of the invention is a wax. The wax acts as solidifying agent in the composition. It assists in the formation of the solid structure of the stick composition. The wax comprises organic compounds or mixtures of high molecular weight substances and is solid at ambient temperature/room temperature. The wax can be a hydrocarbon or ester of a fatty acid or fatty alcohol. Waxes are thermoplastic. Natural, mineral and synthetic waxes can be used herein. As used herein "wax" refers to mixtures as well as a single type of wax.

Natural waxes can be of animal origin, e.g. beeswax, spermaceti, lanolin, shellac wax, of vegetable origin, e.g. carnauba, candelilla, bay berry, sugarcane wax, or of mineral origin e.g. ozokerite, ceresin, montan, paraffin, microcrystalline wax, petroleum and petrolatum wax. Synthetic waxes include polyol ether-esters such as carbowax and hydrocarbon-type waxes, silicone waxes and polyethylene wax. Suitably the waxes useful herein have melting points from about 55°C to about 110°C and are selected from the C<sub>8</sub> to C<sub>50</sub> hydrocarbons, alcohols, acids and esters.

The preferred waxes for use in the present compositions are selected from candelilla, beeswax, carnauba, spermaceti, montan, ozokerite, ceresin, paraffin, modified beeswax, bayberry, castor waxes, synthetic waxes, microcrystalline

waxes and mixtures thereof. More preferably the waxes are selected from microcrystalline, spermaceti, candelilla, modified beeswax, carnauba, ozokerite, paraffin, ceresin, and mixtures thereof.

The wax is used herein at a level of from about 5% to about 70%, preferably from about 10% to about 50%, more preferably from about 15% to about 40% by weight.

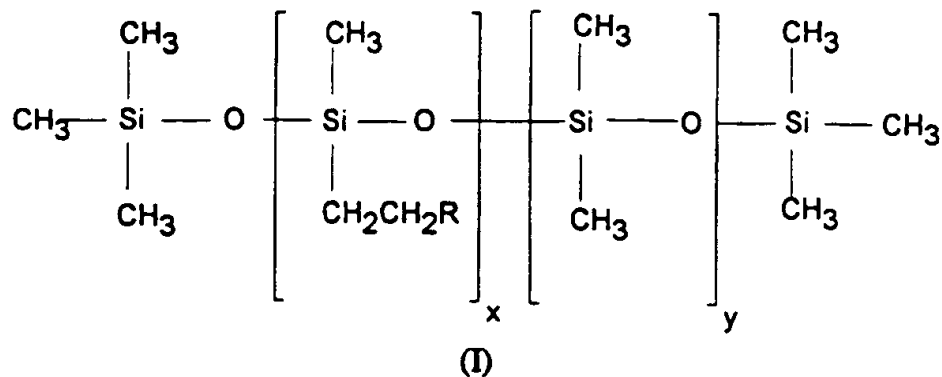
A second essential component according to the first aspect of the present invention is a branched chain hydrocarbon having an weight average molecular weight of from about 100 to about 15,000, preferably from about 100 to 1000. Preferred for use in the compositions herein are branched chain hydrocarbons selected from isododecane, isohexadecane, isoeicosane, isooctahexacontane, isohexapentacontahectane and isopentacontaoctactane, and mixtures thereof, especially isohexadecane and isooctadecane, and mixtures thereof. The branched chain aliphatic hydrocarbon is preferred herein from the viewpoint of providing improved skin adhesion.

Suitable for use herein are branched chain aliphatic hydrocarbons sold under the trade name Permethyl (RTM) and commercially available from Presperse Inc., P.O. Box 735, South Plainfield, N. J. 07080, U.S.A. Particularly suitable herein from the viewpoint of improved skin feel, spreadability and application characteristics is a mixture of isohexadecane and isooctahexacontane.

The branched chain hydrocarbon is used herein at a level of from about 5% to about 40%, preferably from about 10% to about 35% by weight.

Another essential component of the first aspect of the invention is a silicone or mixture of silicones, the silicone or silicone mixture comprising an alkylmethylsiloxane polymer having the formula:





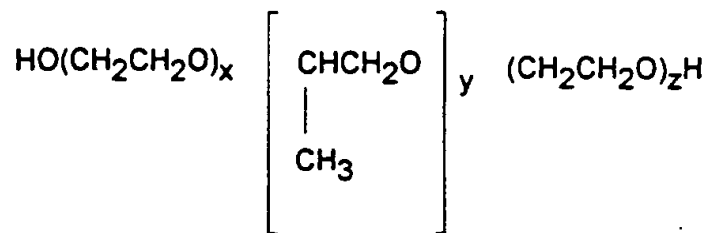
wherein x has a value of from about 1 to about 1000, y has a value of from about 0 to 1000 and R is selected from C<sub>4</sub>-C<sub>50</sub> alkyl. Preferably R is a C<sub>4</sub> - C<sub>24</sub>, more preferably a C<sub>10</sub>-C<sub>20</sub> alkyl group. The silicones are valuable herein from the viewpoint of providing improved spreadability and other application characteristics in oil-free cosmetic stick compositions.

Especially preferred from the viewpoint of providing improved spreadability is stearyl dimethicone.

The silicone or mixture of silicones is used herein in a level of from about 0.01 % to about 20%, preferably from about 0.5% to about 10% by weight.

It is highly preferable in the compositions herein that the anti-acne active is present in the form of a solution, this being important from the viewpoint of delivery of the active to the skin and for providing improved anti-acne efficacy. Particularly effective solubilizers for use in the cosmetic stick formulae of the invention are the polyoxyethylene-polyoxypropylene copolymers. Hence according to a second aspect of the present invention there is provided a cosmetic composition in the form of a non-oily solid stick comprising:

- (a) from about 5% to about 70% by weight of wax;
- (b) from about 1% to about 20% by weight of a polyoxyethylene-polyoxypropylene block copolymer having the formula:



(II)

wherein x has an average value of from about 1 to about 130, y has an average value of from about 10 to about 75 and z has an average value of from about 1 to about 130; and

- (c) from about 0.1% to about 10% by weight of acidic anti-acne active;

and wherein the anti-acne active is pre-solubilised in the polyoxyethylene-polyoxypropylene block copolymer.

Preferably the polyoxyethylene-polyoxypropylene block copolymer for use herein is selected from those materials conforming to the above general formula II wherein x has an average value of from about 1 to about 20, y has an average value of from about 10 to about 40 and z has an average value of from about 1 to about 20. Especially preferred for use herein is the polyoxyethylene-polyoxypropylene copolymer conforming to the above general formula II wherein x has an average value of about 8, y has an average value of about 30 and z has an average value of about 8. This material is commercially available under the tradename Pluronic L-62 (CTFA designation: Poloxamer 182) from BASF. Also suitable for use herein is Synperonic L-62 from ICI.

It is desirable to provide a stick product which has superior anti-acne activity and in this respect cosmetic stick formulae which contain a combination of zinc oxide and acidic anti-acne active in specified proportions is found to be especially effective. Therefore according to a further aspect of the present invention there is provided a cosmetic composition in the form of a non-oily solid stick comprising:

- (a) from about 5% to about 70% by weight of wax;

- (b) from about 3% to about 20% by weight of zinc oxide.
- (c) from about 0.015 to about 10% by weight of anti-acne active.

The zinc oxide used herein preferably has an average particle size of from about 0.1 microns to about 5 microns, preferably from about 0.5 microns to about 1.5 microns.

The compositions of the invention can also contain a gelling/thickening agent at a level preferably from about 0.1 % to about 20%, more preferably from about 1 % to about 15%, and especially from about 2 % to about 10%.

Suitable gelling/thickening agents for the compositions of the present invention include magnesium aluminium silicate ( $\text{Al}_2\text{MgSi}_2$ ), bentonite, hectorite and derivatives thereof. Magnesium aluminium silicate occurs naturally in such smectite materials as colerainite, saponite and sapphire. Refined magnesium aluminium silicate useful herein is available from the R.T. Vanderbilt Company, Inc. under the trade name Veegum (RTM) and from ECC America under the trade name Gelwhite MAS-H (RTM). Modified magnesium aluminium silicate materials such as magnesium aluminium silicate mineral CMC are available from the R.T. Vanderbilt Company, Inc. under the trade name Veegum Plus (RTM). This modified clay material contains smectitic clay with sodium carboxy methyl cellulose and titanium dioxide. Bentonite is a native hydrated colloidal aluminium silicate clay available from ECC America under the trade name Bentonite H (RTM) and from Whittaker, Clark and Daniels under the trade name Mineral Colloid BP 2430 (RTM). Hectorite is one of the montmorillonite minerals that is a principal constituent of bentonite clay. Hectorite is available from Rheox Inc. under the trade names Bentone EW (RTM) and Macaloid (RTM).

Preferred gelling agents for use herein include those sold under the tradename Bentone, especially Bentone Gel TN.

Another desirable component herein is a pigment/colouring agent. Suitable pigments for use herein can be inorganic and/or organic. Also included within the term pigment are materials having a low colour or lustre such as matte finishing agents, and also light scattering agents. Examples of suitable

pigments are iron oxides, acylglutamate iron oxides, ultramarine blue, D&C dyes, carmine, and mixtures thereof.

The compositions can also include at least one matte finishing agent. The function of the matte finishing agent is to hide skin defects and reduce shine. Such cosmetically acceptable inorganic agents, i.e., those included in the CTFA Cosmetic Ingredient Dictionary, Third Ed., as spherical silica, hydrated silica, silicone-treated silica beads, mica, talc, polyethylene, titanium dioxide, bentonite, hectorite, kaolin, chalk, diatomaceous earth, attapulgite and the like may be utilized. Of particular usefulness as a matte finishing agent is low lustre pigment such as titanated mica (mica coated with titanium dioxide) coated with barium sulfate. Of the inorganic components useful as a matte finishing agent low lustre pigment, talc, polyethylene, hydrated silica, kaolin, titanium dioxide and mixtures thereof are particularly preferred. Materials suitable for use herein as light-scattering agents can be generally described as spherical shaped inorganic materials having a particle size of up to about 100 microns, preferably from about 5 to about 50 microns, for example spherical silica particles.

The total concentration of the pigment may be from about 0.1 to about 35% by weight and is preferably from about 1 to about 30% by weight of the total composition. The preferred compositions contain from about 2% to about 30% by weight of titanium dioxide and most preferably from about 5% to about 25% by weight of titanium dioxide.

The composition may also contain additional materials such as, for example, fragrances, fillers such as nylon, sun-screens, preservatives, proteins, antioxidants and chelating agents.

Another optional component of the make-up composition is one or more ultraviolet absorbing agents. Ultraviolet absorbing agents, often described as sunscreening agents, can be present in a concentration in the range of between about 1% and about 12% by weight, based on the total weight of composition. Preferably, the UV absorbing agents constitute between about 2% and 8% by weight. More preferably, the UV absorbing agents can be present in the composition in a concentration range of between about 4% and about 6% by weight. Of the ultraviolet absorbing agents suitable for use herein,

benzophenone-3, octyl dimethyl PABA (Padimate O) and mixtures thereof are particularly preferred.

A chelating agent can also be incorporated in the composition. A chelating agent is preferably present in the composition in a concentration in the range of between about 0.02% to about 0.10% by weight, based on the total weight of the composition. Preferably, the chelating agent is present in a concentration in the range of between about 0.03% and about 0.07% by weight, based on the total weight of the composition. Among the chelating agents that may be included in the composition trisodium EDTA and tetrasodium EDTA.

Another optional but preferred component of the composition is one or more preservatives. The preservative concentration in the composition, based on the total weight of that composition, is in the range of between about 0.2% and about 0.8% by weight, preferably between about 0.4% and about 0.6% by weight. Suitable preservatives for use herein include diazolidinyl urea, methyl paraben, ethyl paraben and propyl paraben, and mixtures thereof.

The compositions herein may also comprise additional anti-bacterial agents such as cetrimonium chloride, cetrimonium bromide, chlorhexidine, triclosan, citricidal, usnic acid and tea tree oil. These additional anti-bacterial agents are generally present at a level of from about 0.01% to about 10% by weight.

The compositions herein are preferably substantially free (ie. contain less than about 5%, more preferably less than 1%) of polar solvents such as water or alcohols.

The stick compositions of the invention can be in the form of concealers and lipsticks.

The following Examples illustrate compositions of the invention in the form of anti-acne concealer sticks.

**EXAMPLES I-V**

	<u>I/%</u>	<u>II/%</u>	<u>III/%</u>	<u>IV/%</u>	<u>V/%</u>
	-----to 100-----				
Titanium Dioxide					
Red Iron Oxide	0.5	0.92	1.0	0.95	0.8
Yellow Iron Oxide	2.2	2.0	2.15	2.5	2.3
Black Iron Oxide	0.47	0.5	0.55	0.3	0.48
Isohexadecane	22	19.5	18.9	20.0	19.9
Bentone Gel TN	9.5	9.5	9.5	9.5	9.5
Carnauba Wax	7.0	6.5	6.9	7.5	7.2
Candelilla Wax	4.75	5.1	5.2	4.8	4.5
Ozokerite	14.5	13.0	15.0	14.0	14.7
Poloxamer 182	6.7	6.5	6.3	6.1	5.9
Salicylic Acid	2.0	2.0	1.0	2.0	2.0
Propyl Paraben	0.1	0.1	0.1	0.1	0.1
Isooctahexacontane	9.6	10.0	9.8	9.5	9.75
Stearyl Dimethicone	2.0	1.5	0.75	1.2	1.0
Cetrimonium Bromide	0.5	0.5	0.5	0.5	0.5
Zinc Oxide	0.0	0.0	0.0	8.0	8.0

The compositions of the present invention can be prepared as follows.

A water bath is heated to 75°C. The branched chain hydrocarbons are placed in a first flask together with gelling agent. The flask is then placed in the water bath and the contents of the flask is stirred continuously using an overhead stirrer until well dispersed. The silicone is then added to the flask with stirring. The pigments, preservatives and zinc oxide, if present, are then processed in a coffee mill until evenly dispersed before being added to the flask.

Next the anti-acne active is dissolved in the polyoxyethylene-polyoxypropylene copolymer with stirring and gentle heating. Separately the waxes are melted in a second flask over a hot plate heated to about 85°C.

The overhead stirrer in the first flask is replaced with a Silverson homogenizer. The melted waxes are then added to the first flask and the resulting mixture is homogenised for 15 minutes on full power. The anti-acne active mixture is added

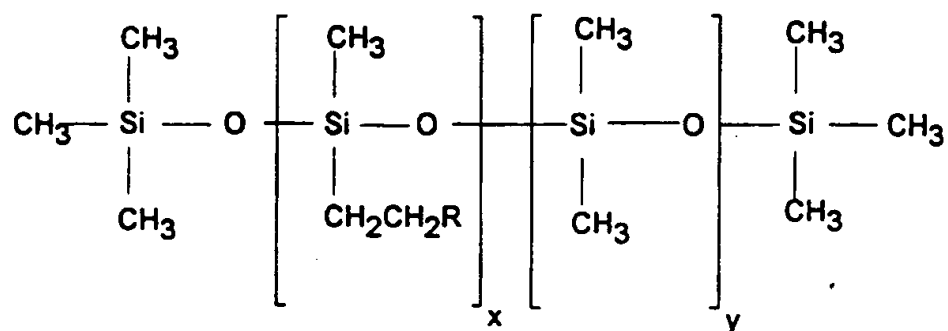
to the first flask and the resulting mixture is homogenised for a further 1 minute on full power.

The molten mixture is poured into moulds which have been pre-treated with silicone spray and left to cool for 15 minutes. The moulds are then placed in a freezer at a temperature of  $-5^{\circ}\text{C}$  to  $-15^{\circ}\text{C}$  for 15 minutes before the sticks are removed from the mould.

The compositions of the above Examples exhibit improved skin feel, spreadability and application characteristics, together with anti-acne activity.

## WHAT IS CLAIMED IS:

1. A cosmetic composition in the form of a non-oily solid stick comprising:
  - (a) from about 5 % to about 70 % by weight of wax;
  - (b) from about 1 % to about 40 % by weight of branched chain aliphatic hydrocarbon having a weight average molecular weight of from about 100 to about 15,000; and
  - (c) from about 0.01 % to about 10 % by weight of silicone or mixture of silicones, the silicone or silicone mixture comprising an alkylmethylsiloxane polymer having the formula:



wherein  $x$  has a value of from about 1 to about 1000,  $y$  has a value of from about 0 to 1000 and  $R$  is selected from  $\text{C}_4$ - $\text{C}_{50}$  alkyl.

2. An cosmetic composition according to Claim 1 wherein the branched chain aliphatic hydrocarbon has an average molecular weight of from about 200 to about 1000.
3. A cosmetic composition according to Claim 1 or 2 wherein the branched chain aliphatic hydrocarbon is selected from isododecane, isohexadecane, isoeicosane, isooctahexacontane, isohexapentacontahectane and isopentacontaoctactane, and mixtures thereof.



4. A cosmetic composition according to any of Claims 1 to 4 wherein the branched chain aliphatic hydrocarbon is selected from isohexadecane and isooctahexacontane and mixtures thereof.
5. A cosmetic composition according to any of Claims 1 to 4 comprising from about 10 % to about 35 % by weight of branched chain aliphatic hydrocarbon.
6. A cosmetic composition according to any of Claims 1 to 5 wherein R is a C<sub>4</sub>-C<sub>24</sub> alkyl group.
7. A cosmetic composition according to any of Claims 1 to 6 wherein the alkylmethylsiloxane is stearyl dimethicone.
8. A cosmetic composition according to any of Claims 1 to 7 comprising from about 0.5% to about 10% by weight of the silicone or mixture of silicones.
9. A cosmetic composition according to any of Claims 1 to 8 wherein the wax is selected from candelilla wax, beeswax, carnauba wax, spermaceti wax, montan wax, ozokerite wax, ceresin wax, paraffin wax, modified beeswax, bay berry wax, castor waxes, synthetic waxes, microcrystalline waxes, and mixtures thereof.
10. A cosmetic composition according to Claim 9 wherein the wax is selected from carnauba wax, candelilla wax and ozokerite wax, and mixtures thereof.
11. A cosmetic composition according to any of Claims 1 to 10 comprising from about 10% to about 50%, preferably from about 15% to about 40% by weight of wax.
12. A cosmetic composition according to any of Claims 1 to 11 additionally comprising from about 0.1 % to about 10% by weight of anti-acne active.
13. A cosmetic composition according to Claim 12 wherein the anti-acne active is selected from salicylic acid, retinoic acid, azelaic acid, lactic

acid, glycolic acid, pyruvic acid, flavonoids, and derivatives and mixtures thereof.

- 14. A cosmetic composition according to Claim 13 wherein the anti-acne active is salicylic acid.**
- 15. A cosmetic composition according to any of Claims 1 to 14 additionally comprising from about 0.1 % to about 20% by weight of gelling agent.**
- 16. A cosmetic composition according to any of Claims 1 to 15 additionally comprising from about 0.1 % to about 40% by weight of pigments/colouring agents.**
- 17. A cosmetic composition according to any of Claims 1 to 16 wherein the composition is substantially free of polar solvents.**

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US95/13816

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(6) : A61K 7/00, 7/035, 31/00, 31/01 US CL : 424/47, 401; 514/772, 844, 847, 859 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 424/47, 401; 514/772, 844, 847, 859  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) APS: Anti(p)acne, hydrocarbon, aliphatic, silicone, siloxane.		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US, A, 5,382,432 (MCCOOK ET AL.) 17 JANUARY 1995, COLUMN 5, LINES 23-25; COLUMN 5, LINES 45-46; COLUMN 6, LINES 5-7.	1-17
X	US, A, 5,292,530 (MCCREA ET AL.) 08 MARCH 1994, SEE ENTIRE DOCUMENT.	1-17
A	US, A, 5,227,169 (HEIBER ET AL.) 13 JULY 1993, SEE ENTIRE DOCUMENT.	1-17
A	US, A, 3,683,091 (NAGATA ET AL.) 08 AUGUST 1972, SEE ENTIRE DOCUMENT.	1-17
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
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